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(56) Documents Cited
WO 94/04739 A1 US 5171339 A US 4681792 A

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(54) Industrial Fabrics

(57) A cut resistant composite fabric comprises a first fabric layer of a high tenacity fibre material and a second fabric layer of a non-woven fabric comprising aramid fibres, the high tenacity fibre material preferably having a tenacity of at least 1N/tex.

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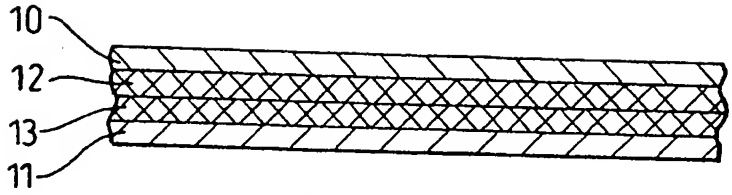

Fig. 1

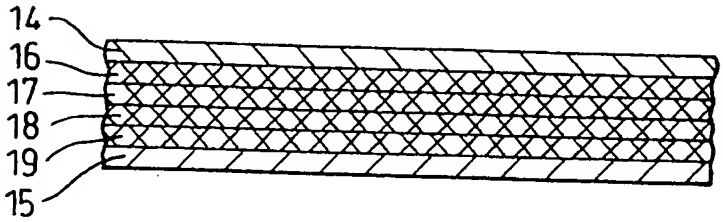

Fig. 2

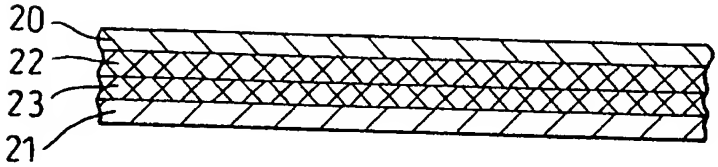

Fig. 3

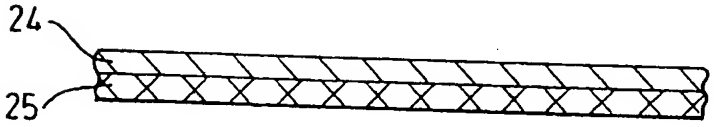

Fig. 4

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Industrial Fabrics

This invention relates to textile fabrics suitable for use in clothing and upholstery applications where there is a need to confer protection against the effects of fire and/or mechanical damage. Such fabrics are commonly used in road and/or railway seating applications, especially as a cover layer for resilient foam cushioning material. Polyurethane compositions are widely used for such cushioning material and in the event of fire are likely to release toxic fumes. It is therefore highly desirable that the cushioning material shall be protected from the effects of fire for at least long enough to enable any passengers to be evacuated from the area. It is also very desirable that the cover layer for such cushioning should have good resistance to mechanical damage, since the latter would adversely affect the fire protection otherwise conferred by the cover. Vandalism is the major cause of mechanical damage to public transportation seating.

In the case of clothing for use in industrial environment, resistance to mechanical damage is often important in order to protect the wearer from injury, or at the least, from damage to normal clothing worn beneath a protective suit.

Fabrics for this type of end use are well-known. For example, GB-A-2466097 discloses a composite fabric including a layer of knitted wire mesh. This has good resistance to knife attack, but the presence of the wire component confers a harsh feel. Also, in the event of damage, projecting wire strands may present a hazard to users. This is particularly true in the case of clothing, where the incorporation of wire mesh may be wholly unacceptable.

It has now been discovered that it is possible to eliminate the need for the wire mesh fabric layer, whilst retaining excellent resistance to mechanical damage and in particular, resistance to cut/slash type damage.

According to the present invention, a cut-resistant composite fabric comprises a first layer of a fabric of a high tenacity fibrous material and a second layer of a non-woven fabric comprising aramid fibres. "High tenacity" in this present context means a tenacity of at least 1N/tex, more preferably in excess of 2N/tex.

Preferably the two layers are bonded by needling them together, although stitching and glueing techniques may also be used.

Particularly preferred high tenacity fibrous materials include polymeric materials such as ultra-high molecular weight polyethylene or aromatic polyesters. The first fabric layer may be a relatively open woven or knitted fabric; it could also b a non-woven fabric incorporating ultra-high molecular weight fibres in the form of laid-in yarns.

"Ultra-high molecular weight" in this present context is a term of art; it is commonly applied to a range of materials, including for example DYNEEMA(TM) and SPECTRA(TM).

The composite fabric of the present invention may be used in conjunction with a third fabric layer which serves as a decorative outer layer when used to cover foam cushioning material. This third layer may be attached by use of glueing techniques, or it may be loose. Attachment is preferred, because it transfers at least in part some of the composite fabric properties to the decorative layer. The third layer could be a knitted terry fabric for example, or more usually a miquette fabric.

The ultra-high molecular weight fibrous material is preferably a polyethylene filamentary material wrapped with staple viscose fibres or staple aramid fibres, as for example by means of the well-known DREF-spinning process. An example of a suitable polyethylene is that sold under the registered trade mark DYNEEMA and for many applications a relatively open scrim weave has been found to be satisfactory. Wrapping with other fibres serves primarily to stabilise the scrim fabric; it has minimal relation to cut resistance.

Example 1:

Referring first to Figure 1, a four layer product comprises facing layers 10, 11 and inner layers 12, 13. The facing layers were each made from 60/30/10 blend by weight of para-aramid fibres, pre-oxidised acrylic fibres and polyacrylate fibres, respectively. The fibre blend was processed by needling to form a felt of weight about 120 g/m^2.

The inner layers were each in the form of a scrim fabric woven from 44 tex DYNEEMA (TM) ultrahigh molecular weight polyethylene yarn covered with 22 tex staple viscose fibres by a DREF-spinning process. The resultant yarn was doubled to give a yarn of about 135 tex prior to weaving at a nominal 42 ends by 42 picks/dm, to yield an open scrim fabric of density about 120g/m^2 containing

about 80 g/m^2 of the ultrahigh molecular weight component. The viscose was included essentially as a weaving/processing aid, but was also found useful in subsequent needling together of the four layers of Figure 1, in a free-standing needling machine. The end product exhibited excellent cut resistance.

Example 2:

Referring now to Figure 2, a six layer composite fabric was made with outer layers 14, 15 and four inner layers, 16,17,18 and 19. The outer layers 14, 15, in this case were each needlefelts of 100% para-aramid fibres and of density 240 g/m^2. The inner layers 16, 17, 18 and 19 were each made as per the inner layers 12, 13 of Figure 1, but staple poly-aramid fibres were substituted for viscose fibres. All six layers were united into a composite fabric by needling them together. Again, the end product exhibited excellent cut resistance.

Example 3:

Referring now to Figure 3, a four layer composite fabric was made using outer layers 20, 21 and inner layers 22, 23. The outer layers 20, 21 were of the same 100% para-aramid construction as layers 14, 15 of Figure 2. The inner layers 22, 23 were exactly as per layers 12,13 of Figure 1, using viscose covered DYNEEMA yarn. As before, the four layers were united by needling to form a composite fabric and the product again exhibited excellent cut resistance.

Example 4:

Referring now to Figure 4, a two layer composite was made by needling together layers 24 and 25. Layer 24 was a needle felt of 100% para-aramid fibres, exactly as per layers 14, 15, 20 and 21 of Figures 2 and 3 respectively. Layer 25 was a commercially-

available felt of density 200g/m^2 constituted by DYNEEMA(TM) fibres and sold under the trade mark FRAGLITE. These two layers were united into a composite, non-woven fabric by needling, as before. The product had excellent cut resistance.

CLAIMS

1. A cut resistant composite fabric comprising a first fabric layer of a high tenacity fibre material and a second fabric layer of a non-woven fabric comprising aramid fibres.

2. A composite fabric according to claim 1 wherein the high tenacity fibre material has a tenacity of at least 1N/tex.

3. A composite fabric according to claim 1 or claim 2 wherein the high tenacity fibre material has a tenacity of at least 2N/tex.

4. A composite fabric according to any preceding claim wherein the high tenacity fibre material is polyethylene.

5. A composite fabric according to any preceding claim wherein the aramid fibre component is a para-aramid fibre.

6. A composite fabric according to any preceding claim wherein the first fabric layer is a non-woven fabric.

7. A composite fabric according to any of claims 1 to 5 wherein the first fabric layer is a relatively open woven scrim fabric.

8. A composite fabric according to any of claims 1 to 5 wherein the first fabric layer is a knitted fabric.

9. A composite fabric according to claim 7 wherein the high tenacity fibre material is a polyethylene yarn wrapped with staple viscose fibres.

10. A composite fabric according to claim 7 wherein the high tenacity fibre material is a polyethylene yarn wrapped with staple aramid fibres.

11. A composite fabric according to any of claims 1-5, or 7-10 wherein the first fabric layer is a woven scrim fabric having a density in the range 50-150 g/m^2.

12. A composite fabric according to any preceding claim wherein the second fabric layer has a density in the range 50-150 g/m^2.

13. A multi-layer Composite fabric according to any preceding claim wherein a plurality of said first fabric layers are sandwiched between two or more of said second fabric layers, the whole being united by needling.

14. A cut resistant Composite fabric substantially as described in relation to examples 1-4 and as illustrated by Figures 1-4.

The Patent Office

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Claims searched: 1 to 14

Examiner: R.J.MIRAMS
Date of search: 14 January 1997

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): B5N

Int Cl (Ed.6): A41D 31/00, 31/02. B32B 5/06, 5/26. F41H 1/02, 5/04.

Other: ONLINE: WPI,CLAIMS.

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 94/04739A1 (Du Pont) whole document	at least 1, 4 to 6, 11 and 12
X	US 5,171,339A (Forsten) whole document	at least 1, 5, 6 and 12
X	US 4,681,792A (Harpell) e.g. claims 10 and 17	at least 1 to 6 and 8

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.